

# **APPARATUS FOR DETECTING AND PREVENTING FLUID LEAKS IN A PROPERTY**

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## 10 **Field of the Invention**

The invention relates to systems and processes for automatically detecting and stopping fluid leaks on a property. The invention stops the fluid (typically water) related damage that is caused by undetected leaks throughout a property from sources such as toilets, hot water heaters,  
15 sinks, washing machines, water makers and broken pipes.

## **Background of the Invention**

Water detection systems are known and have been in use for many years. Typically,  
20 water detection systems include a water sensor unit that is hard wired to a security system or as a stand alone system that gives a visible or audible alarm only. These systems may detect and stop leaks that come from toilets, hot water heaters, sinks, washing machines, water makers and broken pipes and other potential fluid leak sites.

The main problem with conventional water detection systems is that they are generally  
25 hard wired products that are expensive and difficult to install within existing properties. Routing hard wires within an existing property typically requires either leaving the wires in an exposed and visible condition or running the wires through walls and above ceilings. Exposed and visible wires create their own safety problems and running wires through walls or above ceilings tends to be difficult and expensive.

30 Another problem with conventional water detection systems is that existing products can shut off individual valves on washing machines, sinks or the like, but not the main fluid valve. This approach requires a shut off valves for every possible fluid leak source thereby increasing the cost of the system. In addition, if the detected fluid came from a fluid source other than the predicted fluid source, then the wrong shut off valve may be activated thereby allowing the leak

to continue to cause damage on the property.

Another problem with conventional water detection systems is that they do not easily indicate where the leak was detected. This can cause delays in locating and fixing the leak on the property thereby possibly allowing additional damage to occur.

5 Applicants have therefore noticed that there is a need for a system that is easy and inexpensive to install (even on existing properties), is capable of reliably removing the source of the fluid for a leak and assists in determining the location of the leak.

### **Summary of the Invention**

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In view of the foregoing disadvantages inherent in the known types of water detection systems in the prior art, the invention provides a new apparatus for detecting and stopping fluid leaks in a property. The system may be utilized for the reduction of fluid related damage that is caused by undetected leaks throughout a property from sources such as toilets, hot water heater,  
15 sinks, washing machines, water makers, broken pipes or other uncontained fluid sources.

An object of the invention is to provide a fluid detection and prevention system to prevent floods in properties that will overcome one or more of the shortcomings of the prior art devices.

Another object is to provide a fluid detection and prevention system to prevent floods in  
20 properties thereby reducing fluid related damage caused by undetected leaks throughout a property from sources such as toilets, hot water heater, sinks, washing machines, water makers and broken pipes.

Another object is to provide a fluid detection and prevention system to prevent floods in properties that can be easily installed in existing housing or properties to shut off water in case of  
25 a leak.

Another object is to provide a fluid detection and prevention system to prevent fluid damage in properties that may have a base unit that can receive RF signals from one or more sender units located at one or more potential fluid leakage sites.

Another object is to provide a fluid detection and prevention system to prevent fluid  
30 damage in properties wherein the base unit and shut off valve are in communication via RF signals at established frequencies approved by the Federal Communications Commission.

Another object is to provide a fluid detection and prevention system to prevent fluid damage in properties that has the ability to distinguish between one or more sender units so that a base unit may display where a leak has occurred.

5 Another object is to provide a fluid detection and prevention system to prevent fluid damage in a property that has the ability to shut off by means of an electronic solenoid valve, whether internally or externally activated, or other motorized driven systems that will mechanically shut off the fluid coming into the property from the main supply line into the property.

10 Another object is to provide a fluid detection and prevention system to prevent fluid damage in properties wherein a base unit may activate an automatic shut off valve using a 12 or 24 VAC electrical system for improved reliability and safety.

Another object is to provide a fluid detection and prevention system to prevent fluid damage in properties where a fluid sensor will be battery operated, preferably with a 9 volt battery, to increase the life of the fluid sensor between battery changes.

15 Another object is to provide 24 hour constant monitoring with automatic shut off of a main shut off valve in case no occupant is available when a leak is detected.

Other objects and advantages of the present invention will become obvious to the reader and it is intended that these objects and advantages are within the scope of the present invention.

20 The general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new fluid detection and prevention system. The invention may include one or more sender units, a base unit and a main shut off valve.

The sender units may transmit an RF signals to a base unit. The base unit may transmit an RF signal to a main shut off valve to prevent fluid damage to a property. The system may have many of the advantages of the fluid detection and prevention systems previously  
25 mentioned.

To attain the desire objectives, the present invention includes one or more sender units which preferably include a fluid sensor and a transmitter. The fluid sensor may be include conductive contact points that measures the resistivity or continuity changes when fluid is present between the conductive contact points. The fluid sensor may be an integral part of a  
30 sender unit. The transmitter portion of a sender unit may be a radio frequency device operating within approved FCC bandwidths that may send a signal when fluid is detected by the fluid

sensor to the base unit.

5 The base unit may run on 12 or 24 volts alternating current (VAC). The base unit may receive the RF signal from a transmitter portion of one of the sender units when fluid is detected by the fluid sensor of a sender unit and then the base unit activates a main shut off valve or other  
10 shut-off device on the main incoming fluid line. This stops the flow of fluid to the property thereby reducing or eliminating fluid damage to the property. The base unit may include a main control system that includes circuits and other electronic components to read signal sent from a sending unit and that also activates the automatic shut of valve with internal solenoid external solenoid or motorized mechanical shut off on the fluid main. The base unit may also include a  
15 plurality of LED's for communicating the status of the invention to the user. For example, the base unit may include multicolored LEDs that emit red to indicate that its corresponding sender unit has detected a leak, green to indicate normal operation of its sender unit with no leaks, and yellow to indicate a low battery or a test condition for its sender unit.

15 There has thus been outlined, rather broadly, the features of the invention in order that the detailed description thereof may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional features of the invention that will be described hereinafter.

20 To the accomplishment of the above and related objects, this invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that changes may be made in the specific construction illustrated.

### **Brief Description of the Drawings**

25 Fig. 1a illustrates a top view of a sender unit;  
Fig. 1b illustrates a perspective view of a sender unit;  
Fig. 1c illustrates a side view of a sender unit;  
Fig. 1d illustrates another side view of a sender unit;  
Fig. 2 is a drawing of a base unit;  
30 Fig. 3 is a drawing of an automatic shut off valve system;  
Fig. 4 is a drawing of the automatic shut off valve with an incoming and outgoing fluid delivery

lines; and

Fig. 5 is a drawing illustrating the connections between the various parts of the invention.

### **Detailed Description of the Preferred Embodiments**

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The present invention will now be discussed in detail with regard to the attached drawing figures which were briefly described above. In the following description, numerous specific details are set forth illustrating Applicants' best mode for practicing the invention and for enabling one of ordinary skill in the art to make and use the invention. It will be obvious, however, to one skilled in the art that the present invention may be practiced without many of these specific details. In other instances, well-known machines and process steps have not been described in particular detail in order to avoid unnecessarily obscuring the present invention. Unless otherwise indicated, like parts and processes are referred to with like reference numerals.

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### **15 OVERVIEW**

The overall purpose and function of the invention will now be disclosed with reference to Fig. 5. The invention may be used to detect and stop fluid leaks on a property 404 that might otherwise cause fluid damage to the property 404 or to individuals on the property 404. The disclosed detection and prevention system is inexpensive and easy to install (even in existing properties), may be used to simultaneously monitor multiple possible leak locations on a property 404, will reliably stop a fluid leak once detected and may assist in locating the source of the fluid leak. The invention includes one or more sender units 400, a base unit 403 and a main shut off valve 407. The sender units 400 may advantageously be positioned throughout the property at locations that are likely to experience a fluid leak. Once a sender unit 400 detects a fluid leak it may communicate this information to the base unit 403. The base unit 403 may then display the location of the sender unit 400 (and therefore the location of the fluid leak) via the use of LEDs and the base unit 403 may also communicate a command to a main shut off valve 407 to restrict the flow of fluids onto the property 404 from a fluid source 406.

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## SENDER UNIT - 400

The invention may include one or more sender units 400 that continuously monitor for fluid leaks. The sender units 400 are preferably small and easily moveable electronic device that will typically include a fluid sensor 401 and a transmitter 402. To facilitate their ease in placement in various locations on a property 404, the sender units 400 are preferably powered by batteries.

### Fluid Sensor - 401

Fig. 1a illustrates a top view, Fig. 1b illustrates a perspective view, Fig. 1c and 1d illustrate different side views of an exemplary sender unit 400. The fluid sensor 401 may use any number of known techniques for detection of a fluid. In a preferred method, the fluid sensor 401 uses conductive wires (best seen in Fig. 1c) that may have a voltage drop, for example up to 2 volts, between them. When fluid is present between the wires the resistivity or continuity changes and this change is detected and activates a switch signaling that the resistance or continuity has changed. A sealed plastic outer case may be used to house the working electronic devices within the fluid sensor 401. The conductive wires are advantageously positioned through the bottom of the case and are exposed facing downward toward the floor or other area to facilitate the sensing of fluids.

### Transmitter - 402

The sender units 400 may be constructed in such a way as to detect the changes in resistivity or continuity from the conductive wires that make up the fluid sensor 401. It is this change in resistivity or continuity, due to the presence of a fluid between the wires, that may be used to activate the electronics in the sender unit 400, i.e. transmitter 402, to respond with a signal that is transmitted using an RF electronic chip or circuit at a desired frequency to the base unit 403. It is very desirable for each transmitter 402 to use a unique identifier as part of the RF signal so that the base unit 403 may easily tell which of its sender units 400 made the

transmission. This allows the base unit 403 to determine the location of the fluid leak on the property 404. The ability of the RF signal to penetrate walls and other structures makes it ideal for eliminating the need for individual wiring from the sender units 400 to the base unit 403.

5 The power level of the transmitters 402 may be made to be adjustable. This allows the transmitters 402 to use a less powerful RF signal on smaller properties 404 or a more powerful RF signal on larger properties 404.

### **BASE UNIT - 403**

10 The base unit 403, an exemplary one is illustrated in Fig. 2, may operate as the main control system that includes circuits and other electronic components to read signals from the one or more sender units 400. Once a signal from a sender unit 400 indicating a leak is detected, the base unit 403 may send a signal to a solenoid valve 407 that may be installed on an incoming water line. The solenoid valve may have a plunger that once activated will close the valve  
15 automatically stopping the flow of fluids through the main water supply line. The base unit 403 preferably runs off a 12 or 24 VAC power supply, but as is known in the art, may be powered by other electrical sources.

The base unit 403 may also include test functions to measure the amount of power the sender units 400 have left before their batteries need to be changed. The base unit 403 may  
20 activate a test scheme to read the signals from each individual sender unit 400 to determine the life of the battery that operates the sender unit 400. If the signal is too weak the base unit 403 may use a light emitting diode (LED) to indicate the need for new batteries or other maintenance required on one of the sender units 400.

The base unit 403 may also feature the ability to shut off the main water without  
25 physically moving a valve on the main water line. The base unit 403 is preferably housed in a plastic case with wires going to the main shut off valve 407. In this embodiment, the base unit 403 is installed as close to the main shut off valve 407 as possible. In another embodiment, the base unit 403 may communicate with the main shut off valve 407 via an RF signal (allowing remote operation) to control the opening or closing of the valve 407.

30 The base unit 403 may have the ability to identify which of the sender units 400 sent a signal indicating a leak or other condition. The base unit 403 may then process the signal and

activate the necessary relays within its circuitry to activate the main shut off valve 407 by use of an electronic internal or external solenoid shut off valve or other motorized driven mechanical shut off devices located inline on the main fluid line 409 and 410 from a fluid source 406. In addition, the base unit 403 may have the ability to reset the main shut off valve 407 once the sender unit 400 has been dried.

An alternative embodiment of this invention could use conductive wires instead of RF frequency devices to send the signal from the sender units 400 to the base unit 403. This would mean that hard wires would need to connect the sender units 400 with the base unit 403 to shut off the main shut off valve 407 to the main fluid source 406. Another embodiment would be using the above described RF sender units 400 to send a signal to an individual water source valves (not shown) within a property such as a water line on a washing machine that could shut off the water flow to that individual hose line by use of a shut off valve, such as an electronic solenoid valve.

#### Battery/Power

This base unit 403 may plug into a normal 110/120 volt AC standard outlet for main power which will monitor the plurality of sender units 400 for a fluid leak and also activate the main shut off valve 407 to the main fluid source 406. A step down transformer may be used to convert the 110/120 volt AC power to a 12/ 24 volt AC power supply for additional safety making the unit capable of UL approval. In addition, the base unit 403 will be constructed in such a way as to be compliant for CE or European approval. A battery back-up may be installed in the base unit 403 in case there is a power outage that occurs at the same time as a leak is detected by one or more of the sender units 400.

#### Base LEDs

The base unit 403 preferably has means for quickly displaying and communicating the status of the system and the sender units 400. Light emitting diodes (LEDs) are an excellent choice for this purpose due to their low power consumption, low cost, long life and high reliability of operation. Various quantities and color combinations of LEDs may be used to



indicate various conditions of the system and the sender units 400.

In a preferred embodiment, there is one multicolored LED associated with each of the sender units 400. The LED may emit red to indicate that a sender unit 400 has detected a leak, green to indicate normal operation of the sender unit 400 with no leak, and yellow to indicate a low battery or a test condition for a sender unit 400. This method has been found to be an extremely fast and reliable way for the base unit 403 to accurately communicate the status of each of the sender units 400.

An additional 2 buttons may be available on the base unit 403. The first button may be used to activate the main shut off valve 407, such as an automated electronic solenoid control valve which stops the flow of fluid from the fluid source 406 through the fluid delivery pipes 409 and 410, illustrated in Fig. 4. The second button may be used to reactivate the flow of fluids after the fluid leak has been fixed or for normal maintenance.

## **MAIN SHUT OFF VALVE**

A main shut off valve 407, such as one illustrated in Fig. 3, may be positioned in the fluid delivery pipes 409 and 410, as illustrated in Fig. 4, that deliver fluids from a fluid source 406 to a property 404. The shut off valve 407 may be of any known type, such as an internal or external solenoid or motorized mechanical shut-off device. The shut off valve 407 restricts or stops the flow of fluid to the property 404 thereby reducing or eliminating fluid damage to the property 404.

## **GANG INSTALLATION**

Certain properties 404 may be too large or have too many areas where leak detection is desirable for a single base unit 403 and corresponding sender units 400 to cover. For these properties 404 two or more base units 403 and corresponding sender units 400 may be used. In fact, any number of base units 403 and corresponding sender units 400 may be used. Each sender unit 400 may be given a different code or method of identification to assist each base unit 403 in determining if the transmitting sender unit 400 is one of its sender units 400 and, if it is one of its sender units 400, which specific sender unit 400 it is.

In view of the foregoing, it will be understood by those skilled in the art that the systems and processes of the present invention can facilitate the detection and prevention of fluid leaks on a property. The above-described embodiments have been provided by way of example, and  
5 the present invention is not limited to these examples. Multiple variations and modification to the disclosed embodiments will occur, to the extent not mutually exclusive, to those skilled in the art upon consideration of the foregoing description. Such variations and modifications, however, fall well within the scope of the present invention as set forth in the following claims.